Missouri Department of Natural Resources

Missouri Nutrient Reduction Strategy

Committee Meeting

Wednesday, June 20, 2012, 10:00a.m. – 3:00 p.m.

Bennett Springs and Roaring River Conference Rooms

Department of Natural Resources, 1730 E. Elm Street, Jefferson City, MO 65101

A. CALL TO ORDER

The meeting began on June 20, 2012, in the Bennett Springs/Roaring River conference rooms at the Missouri Department of Natural Resources Elm Street State Office Building located at 1730 E. Elm Street, Jefferson City, MO 65101. A toll free call-in number was provided for committee members who were unable to attend the meeting in person. The meeting was announced in accordance with the Missouri public meetings law.

B. ATTENDEES

The following committee members were in attendance:

Steve Walker - Missouri Department of Natural Resources
Chris Zell – Geosyntec
Bob Broz - University of Missouri Extension, Water Quality
Judy Grundler - Missouri Department of Agriculture, Plant Protection
Steve Taylor - Missouri Agribusiness Association
Scott Totten – Missouri Department of Natural Resources, Director's Office
Mary Culler - Missouri Department of Natural Resources
Darrick Steen - Missouri Department of Natural Resources, Director's Office
Mark White – Environmental Resources Coalition
Bryan Hopkins - Missouri Department of Natural Resources
John Ford – Missouri Department of Natural Resources
John Hoke – Missouri Department of Natural Resources
Ken Struemph – Missouri Department of Natural Resources, Soil & Water Conservation
Leslie Holloway - Missouri Farm Bureau
Claire Baffaut - U.S. Department of Agriculture Research Service
Chris Klenklen - U.S. Department of Agriculture Research Service
Jerri Davis – U.S. Geological Survey Rolla
Colleen Meredith - Missouri Department of Natural Resources

Todd Blanc - Missouri Department of Natural Resources, Permits
Gopala Borchelt – Table Rock Lake Water Quality
Bill Allen - Metropolitan St. Louis Sewer District
Bob Angelo – Environmental Protection Agency
Ed Galbraith – Barr Engineering

COMMITTEE MEMBERS PRESENT VIA PHONE

Charles Steven- City of Liberty
Peter Scharf – University of Missouri, Plant Sciences
Eric Strecker - Geosyntec
Robert Shannon – University of Missouri- Graduate Student
Deanna Osmond – North Carolina State University
Alan Powell – USDA-FSA
Valerie Robinson -Missouri Department of Natural Resources

C. MEETING AGENDA

10:00 a.m. USDA NIFA-CEAP Watershed Synthesis Lessons Learned – Deanna Osmond
11:00 a.m. Announcements Introductions – Steve Walker
11:15 a.m. BMP Database Projects – Eric Strecker- Geosyntec
12:00 p.m. Lunch
1:00 p.m. Continuous CRP Program – Allen Powell (FSA)
1:45 p.m. Discussion: Use of modeling in watershed prioritization and Missouri Nutrient Reduction Strategy outline
2:55 p.m. Next steps/Next meetings
3:00 p.m. Adjourn

D. PRESENTATION- USDA NIFA-CEAP Watershed Synthesis Lessons Learned- Deanna Osmond

Ms. Deanna Osmond began her presentation by giving a brief description of the overall conservation effects assessment project. She stated that she would talk about the NIFA CEAP competitive grant watersheds. These projects started in 2004 where there were thirteen projects that came on board over a three-year period. She stated that in order to be part of this protocol the relationship between conservation practices and water quality effectiveness at a watershed scale has to be addresses, and in order to do that there needed to be anywhere from five to ten years of water quality data as well as geo referenced land treatment data. The initial NIFA CEAP competitive grant watershed project was focused upon cropland and pastureland.

Ms. Osborn then showed where the thirteen projects that were successful in being part of this protocol were located which was as far west as Oregon as far east as New York as far north as Idaho and as far south as Georgia. Deanna said that the pollutant of concern that rose to the top most frequently was phosphorous, followed by sediment, then nitrogen, occasionally atrazine then e. coli. She stated that some of the watersheds were entirely cropland (Georgia, some of them were mixed with cropland and animals (Oregon & Utah) and a few of the watersheds were mixed in that there were a lot of development activities occurring (Arkansas and Indiana). Ms. Osborn then talked about the four principal questions that each of the thirteen projects were expected to try and answer (shown below):

1. What is the relationship between conservation practices and water quality change at a watershed scale?
2. Were relationships between conservation practices complimentary or were they contradictory?
3. What socio-economic factors either increased or decreased conservation practices adoption by farmers?
4. Can we use our models to determine the optimum set of conservation practices in the appropriate location within the watershed to achieve the best water quality goals?

So that kind of sets the framework of the individual thirteen projects and each of these projects in and of themselves have a very significant scientific body of information.

Deanna then briefly went through the protocol. She stated that because these projects were so diverse one from another they really needed a very robust common framework to collect information. She said over a three-year time period, all the information was collected and written to date or presented in whatever kind of format they had it in and put into the template. She said they also conducted site visits which were critically important because about fifty percent of everything learned was through site visits. She said that at the same times that we were conducting site visits, key information interviews of around two hundred people (farmers, project personnel, elective government officials, people working for NGOs, extension) were also conducted. She stated that they then took all the information and developed the lessons learned.

Ms. Osborn then talked about results from the projects relative to water quality change. She stated that six of the projects were able to demonstrate water quality change and seven projects were not. She said it does not mean for the six projects that were able to show water quality change that they met their water quality goals and she specified that in fact none of them met their water quality goals, but they were actually able to show change from conservation practices. She mentioned that something all six projects had in common was that they had the correct conservation practices implemented and they had significant numbers of conservation practices and they all had appropriate monitoring designs. She stated that there were two projects that met these criteria, but for other reasons could not show water quality change. Three of the projects employed long-term water quality monitoring design (Idaho and Ohio) which were both

surface water and Nebraska which was groundwater. Three others used what is considered to be kind of the keystone water quality design, which is paired watershed designs (Iowa, Pennsylvania and New York). Iowa and New York were part of a federal protocol through the U.S. EPA 319 national nonpoint source monitoring program and Pennsylvania did their own paired watershed study without being part of this protocol.

Ms. Deanna Osborn then talked about specific lessons learned which she divided up into three parts:

1. Lessons learned from land treatment,
2. Lessons learned from water quality monitoring
3. Lessons learned from modeling

Ms. Osborn spent the majority of her time on land treatment and could have spent an equal amount of time on water quality and modeling. She said the question that we're trying to answer is what would make conservation practice implementation better. The first lesson learned presented by Ms. Osborn is that you have to identify the appropriate conservation practice or practices. She said you have to first identify the pollutant of concern you're trying to control and match your practice to your pollutant of concern. She stated you then have to identify the pollutant sources. Ms. Osborn stated that with all of the projects, they were looking at sediment with the exception of Kansas which was able to demonstrate that they had done a very good job of reducing erosion from there uplands. She stated that seventy five percent of Kansas's erosion was coming either from streambanks or stored sediments in the stream channels. Ms. Osborn said that lastly you have to know and understand the hydrology because if you don't understand the hydrology you don't necessarily understand which practice needs to be implemented.

Ms. Deanna Osborn then spoke about the next lesson learned - which is that you have to understand how the conservation practice you're selecting work to control the nutrients. She stated that conservation planners should not assume that conservation practices work the way we think they do. She continued on to say that conservation practices may affect different pollutants differentially and we all need to pay attention to how conservation practices work to better understand how those changes that affect water quality. She stated that an Ohio watershed was able to show a change in total phosphorus and total sediment over a monitoring period of thirty years. She said there were conservation tillage areas and about 60%-80% of the watershed went from conventional tillage to conservation tillage in about a three to five year period which was the period where total phosphorus and total sediment reductions were observed.

Ms. Osborn then talked about targeting practices to the critical areas in the watershed. She defined the critical areas as those areas in the watershed that deliver the majority of the pollutant. She stated that three watersheds (Missouri, Kansas and Utah) all used different techniques to identify their critical areas in the watershed. All of these watersheds had relied primarily on NRCS conservation practices and cost-share to be implemented, and therefore they were finding that on average no more than twenty five percent of the conservation practices were in the

critical areas where they needed to be. She said that understanding the farmers' perspective is critically important. She said that one of the things about farmers and applying conservation practices is that it needs to help with increasing yields as management factors are much more important than any of us dreamed. She stated that farmers want practices that reduce their management costs, which is part of the reason conservation tillage has caught on very easily.

Ms. Osborn also talked about understanding farmers' perspective such as when farmers see their soil being lost from their land and they understand the need to control that sediment loss. She stated that farmers don't see nutrients and herbicides leaving their lands, so the ability to see the pollutant really grabs their attention. Ms. Osborn stated that there were four watersheds that either had threats of regulations which caused farmers to do a better job of protecting water quality because the farmers understood that if they did not do a better job of protecting water quality that they could be regulated and they might not like that.

Ms. Osborn talked about the Indiana project where she stated they looked at farmer belief systems and they designated the farmers as either business, environmental or stewardship farmers. She found that there were more conservation practices adopted by the environmental or stewardship farmers. She defined environmental farmers as the farmers that were really concerned about the downstream stream impact of their farming operations, and stewardship farmers were concerned about passing on the quality of their land to succeeding generations or they had religious reasons for their stewardship. Therefore, these two groups tended to adopt conservation practices at a higher rate. Ms. Osborn reiterated that technology changes or trust in a product can have really large impacts on adoption practices and provided an example of being in Ohio where some of the folks there said the reason the farmer's went so quickly from conventional to conservation was that John Deere came out with their no till drill and the farmers really trusted John Deere to have an appropriate product. She then spoke on the Kansas watershed which has moved from conventional tillage (which by conventional means plowing) to conservation tillage.

Ms. Deanna Osborn then talked about how producers and professionals may see these practices very differently. Ms. Osborn stressed that the Utah project was really a nice piece of work where they went and looked at NRCS contracts that had been put in place, and in speaking to farmers, they found they had contracts that had not been fulfilled the way they needed to be and even for the contracts that had been fulfilled, many of the practices were discontinued (particularly the management practices). She then talked about nutrient management, which she stated was important in reducing nutrient losses in watersheds. Ms. Osborn stated that we as professionals need to recognize the multi-variate aspects that the farmer goes through in choosing conservation practices when farmers are thinking about implementing practices.

Ms. Osborn then discussed effective conservation education stating that farmers told NRCS that we as professionals, whether extension, NRCS, or soil and water, don't provide particularly good education to them. She stated that in Oregon there was a great extension agent that would help

when a farmer had a problem. She said that the extension agent would forward that farmer over to another farmer who would solve the problem. She said that the other thing that really works well is when you have a trusted local adviser whose job it is to do nothing but work with the farmers on conservation practice implementation.

Ms. Deanna Osborn then talked about the lessons learned on water quality monitoring. She stated that with most projects if you're trying to link water quality monitoring to the effectiveness of conservation practices that it needs to be limited to a small number of projects. Ms. Osborn said that it is critical to design your watershed monitoring to meet your objectives. She said the most effective strategy is the paired watershed design-where you have a study or treatment watershed and you have a control watershed. The three watersheds with paired watershed designs were able to show changes. She said that trend and load monitoring can be effective, but it has to be long-term water quality monitoring and this strategy is effective in very few places. She then talked about scale where not only is location important, but scale is important, because the larger your scale the more difficult it is to get implementation of conservation practices. She talked about the Iowa project where the treatment watershed had about 25% percent of its land area go into native tall grass prairie with many of the ditches drained in a ten-year period of monitoring. She said that only about 20% of the nitrogen that had been there prior to the conservation changes was showing up in the stream system, therefore hydrologists there were able to show that it was a very long lag-time even for nitrate.

Ms. Osborn stated that some of the projects could not show water quality change because they were simply too large, and in other instances, good monitoring practices weren't necessarily followed. She said that you have to monitor the pollutant being treated, and in some of the watersheds, the pollutant of concern was sediment, but they were monitoring nitrogen. She said that you also have to account for variability - things that are going on in the watershed such as climate and where the pollutant is coming from. Deanna also said that spatial variation is really important and that monitoring duration is a real trick because very few projects are willing to be there for the long term (at a minimum ten years) and most likely twenty to thirty years depending on the pollutant of concern, and the size of your watershed. She reiterated that if you do not monitor frequently enough and you do not monitor for the right things you will not generate adequate load data.

Deanna then talked about using historical data, mentioning that when trying to rely on historical data to go back to the period of record like the NIFA CEAP projects did, it is extremely difficult. She stated that the Utah project thought they had a really robust data set as for water quality and what they realized was that the data couldn’t be used because people had changed monitoring locations and they had changed the pollutants they were monitoring. She then talked about coupling water quality monitoring and land use data stating that you have to know what's going on if you're trying to couple these two things. She then stated that no matter how rigorous the water quality monitoring is, it will be impossible to link observed changes in water quality with land treatment without equal rigorous land treatment management data. She said that there was

no really good reliable data on operation and maintenance and almost all of these projects had great difficulty collecting USDA practice information because of the 2002 farm bill which excludes access to these data. Ms. Osborn stated that there were some projects that had a great working relationship with NRCS and they were able to obtain these data.

Ms. Osborn then talked about modeling lessons learned and this is really abbreviated but again it's because of my time. I can't say enough about how critically importance it is to have skilled personnel. She said it takes an amazing amount of hydrologic and biogeochemical information and understanding of these things and you need to have good computer programming, good GIS skills and you good statistical data. She then talked about selecting the appropriate model and analyzing the results. She stated that it's really important when you are linking models to really understand what you're doing so you don't incorrectly identify critical pollutants. She then talked about using modeling information and monitoring data stating that there may be modeling uncertainties and your monitoring program may not be sensitive enough to detect changes in your pollutant of concern. There may be issues with lag time of your pollutants and there's also degradation of conservation practice due to operation and maintenance issues and then unaccounted for disturbances in the system. She stated that modeling data may overestimate reductions in sediments and nutrients which are really important to know and consider when thinking about models.

Ms. Deanna Osborn then went through and summarized what her team believes are the 15 most important lessons:

1. Conservation planning must be done on a watershed scale with sufficient water quality and modeling information.
2. Before implementing conservation practices, identify the pollutants of concern and the sources of the pollutants.
3. Identify the critical source areas for prioritizing conservation practices.
4. Identify farmer's attitudes in the watershed toward agriculture and conservation practices to promote adoption.
5. Even after conservation practices have been adopted, continue to work with farmers on maintenance and sustained use.
6. Economic incentives were often required for adoption of conservation practices that were not obviously profitable or fitting with current farming systems.
7. Technical assistance to farmers is most effective when delivered by a trusted local contact and is very people-intensive. Reduced funding is eroding the ability of NRCS, Extension and soil and water conservation districts to deliver effective programming.
8. Conservation practice adoption is a multivariate choice and although economics are exceptionally important, there are many other factors that are part of the decision-making process.
9. Most conservation implementation projects should NOT conduct water quality monitoring.

10. For projects that do conduct water quality monitoring, establish monitoring systems that are designed to specifically evaluate response to treatment and ensure that projects include the necessary resources and expertise.
11. To link water quality response to land treatment changes, conservation practice activities must be monitored as intensively as water quality monitoring and at the same temporal and spatial scale.
12. Knowledge of land use, management and conservation practices is absolutely essential to understand effectiveness of conservation programs. Such data are often unavailable due to confidentiality issues or incomplete.
13. Watershed models are very complex. Select the correct model(s) and modify if necessary. Ensure sufficiently trained personnel, well-calibrated and validated models, and adequate water quality and land treatment data, including spatial and temporal changes in these data.
14. The scientific basis of modeling is still evolving. There are still many deficiencies in our knowledge and in existing modeling tools for representation of critical natural processes and key management actions at the watershed scale. In general, the complexity and non-linear nature of watershed processes overwhelm the capacity of existing modeling tools to reveal the water quality impacts of conservation practices.
15. Programs have been funded since 1978 with the goal of understanding conservation practice effects at the watershed scale. Some of the lessons learned in the NIFA-CEAP were observed in these earlier programs and projects, and some are new. The lessons were RARELY integrated into most state and federal programming that funds conservation practices. With dwindling resources and mounting environmental degradation, it is essential that many of the lessons from NIFA-CEAP be integrated into policy and agency protocol if water resources are to be protected or improved.

Ms. Osborn stated that unfortunately those lessons were never integrated into conservation planning for the most part. It is critically important that this time we get these lessons into conservation program because we have dwindling resources and unless we get these steps better in sync with what we know, we're not going to succeed.

Deanna Osborn then talked about controlling pollutants. She said the NIFA CEAP projects, the NRCS cropland studies and some of the ARS watersheds are showing the same thing. She stated that uplands have been well treated in most watersheds but there are outliers like the Kansas watershed where they still have a problem with upland erosion. She stated that most of the sediment is now coming from stream beds and stream banks, not uplands. Ms. Osborn stated that it is going to be significantly more challenging to control nutrients, especially nitrogen, than it has been to control sediments because management practices are harder for farmers to use and it is more difficult for them to implement practices where they cannot see the pollutant that's

leaving the field like nutrients. She said there are antagonistic outcomes of conservation practices such as terraces, grass water ways and drains which she said increases nitrates while reducing sediment. She stated that the hydrology is being changed much faster than any conservation practices are being implemented to control nitrate that can runoff the land. She also stated that there's a huge amount of marginal lands that's going out of CRP and other programs into farming. Ms. Osborn said that the Iowa paired watershed study showed an enormous increase in nutrients, the minute that CRP land was transformed to agriculture. She also reiterated that climate change and the timing and duration of rainfall may also really increase nutrient losses and for all of those reasons, controlling nutrients becomes more difficult. She stated that in order to control nutrients, everyone has to be involved and everybody has to be part of the solution (farmers, agribusiness, agency personnel) if we are going to actually have the most effective conservation practices so we can to deal with this very complex issue. Ms. Deanna Osborn then answered questions:

> Q: Do you have any idea if this information has this been acknowledged by EPA officials within the ranks of those who are involved with some of the water quality activities pertaining to agricultural activities? Has much of it been incorporated into what EPA's doing?
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> A: I will answer that in two ways, we had two objectives in the synthesis project, one is to do what I just showed you, the second is the outreach and from my standpoint (my appointment is primarily Extension) the Extension part is far more important just as I said because we've been learning these lessons for the past fifteen years. Actually EPA is ahead of the curve. About 25 years ago or more when they funded the 319 national monitoring program project, they told their projects that you will use the paired watershed design for the 319 program, so I think EPA is ahead of the curve.
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> Q: Are the farmers just not documenting that they're following the nutrient management plans and they're still probably doing it in the field or do you really know that they weren't following the nutrient management plan because you looked at documentation that they had?
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> A: There was one project in particular where we were told that the farmers were not using their nutrient management plan or they were not reporting the amount of nutrients they were using. In interviewing our farmers, it was really clear that in many states they felt their state recommendations for nitrogen were not sufficient and they were putting on more nitrogen. In some of these instances, they were required to have a nutrient management plans and in others they weren't.
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> Q: Which conservation practices may be the most effective in reducing nutrient loads based on these CEAP studies?

A: No. The first question that you guys need to ask is what is the major pollutant of concern and I'm assuming that for you all because you're in Mississippi River Basin that is nitrogen, is that correct?

Q: I would say both nitrogen and phosphorus, probably phosphorus is more critical in the state of Missouri itself.

A: So what you guys are going to have to do is step back and say okay what is it we are trying to control, and then if you're trying to control both nutrients as I showed in some of my work for instance, conservation tillage may reduce sediment & total P, but if the farmers change the way they apply their fertilizer, you may actually increase soluble P, it also may increase nitrate leaching losses and if you have drain tiles you may actually speed up nitrogen. So as a group, you're going to need to bring in your experts in the state that can help with these decisions and you may need to find solutions that are not optimal for either pollutant. By controlling phosphorus you may be increasing nitrogen so again I would walk through the process set forward, look at the pollutant of concern and talk about what kind of practices are most effective in reducing those pollutants of concern. You may decide for instance you want to control phosphorus first. Timing for nitrogen is one of the best practices you can do. Switching from fall to spring would be one of the best things you can do – get you nitrogen out when your crop is growing. There's data from Minnesota that shows that this is true, you have the least amount of nitrate losses to your drain tile if you get it out in the spring.
Q: Are you seeing in most of the stream banks the buffers that these people need, or is it the stream practices that are really going to stop the erosion.

A: I think it's a function of the stream itself, how down-cut it is, what type of vegetation you have holding that stream bank together because if we're trying to reduce nitrate or nitrogen because we have appropriate flow pass-through the shallow groundwater, then we don't care what kind of vegetation it is. So in-stream practices would be OK, but I think we were thinking more of riparian buffers and potentially stream restoration.

Q: On your nitrogen losses in looking at some of your monitoring, were any of these sites on the place where you had cover crops?

A: I don't think so. Oregon had cover crops in some places, but they had really unique and relatively low nitrogen losses. There were some cover crops in Missouri and there may have been one or two more cover crops; but no, not significantly.

Q: What your thoughts are on the SPARROW model?

A: We had a USGS person down here in North Carolina running SPARROW for North Carolina and it's for this river basin that I work in and it's regulated. It was showing the

majority of the nitrogen pollutant was coming from the upper area of the river basin, not lower area. The upper basin of the river basin has minor agriculture, most of its pasture land, and it's grossly under fertilized and the data made no sense to me because it wasn't showing the delivery of nitrogen where it should have been. So I talked to him and he had used fertilizer sale statistics which in my state are totally relevant because it's where the fertilizer is distributed, not where it's used, and as a consequence, the information was completely wrong therefore, I am not comforted by what I have seen.

Q: Can you talk about nutrient trading in Chesapeake Bay?

A: I have a real concern about nutrient trading. The concept actually got started here in a regulatory river basin, it never went anyplace because of the point sources. People figured out that it was way cheaper for them to do what they had to do than to trade. We also have another regulated river with two more regulated watersheds where trading has been written into the rules and we are struggling with how to do that. I have a real concern about trading point source with nonpoint source because of all the lag times associated with nonpoint source particularly agriculture vs. point source that you're putting directly into the stream. In my state, we've been looking at riparian buffers effective ness for reducing nitrogen and about 12 years ago we gave 50 % for riparian buffers and 85% for nitrogen reduction. I have real concerns about trading because I don't think we understand our systems, I don't think we have great numbers for our conservation practice effectiveness. In addition, any conservation practice effectiveness if you look at the literature can range from 100% to a negative number and which number do you pick? People pick these numbers and it's like one size fits all. I have real concerns! It has some conceptual difficulties that we haven't worked through and the last point is that in my watersheds we're looking at development doing trading with the agriculture community as development has so much more money than agriculture that they can go in and buy all their credit reductions and agriculture will not meet their credit reduction. Even then, I still don't think with safety factors that it's a trade for a trade because storm water puts nutrients directly into streams. I think on paper, trading looks great, but I think the reality of it and the biophysical reality is concerning.

Q: You said some of the projects had not met goals and you said a number of reasons were related to modeling uncertainty such as things like the farmers application of nutrients, and I was wondering if you think there's one factor that's more important to uncertainty like not knowing what the numbers are in reference to those seven that weren't able to show water quality change?

A: The Georgia project had great water quality monitoring. They had 30 years of high quality data. but only 40% of the land area in that watershed is agricultural and they have these immense buffers around their streams because they're hydric soils and so those riparian buffers really protect the stream system from pollutants so they met some of the

criteria that we talked about, but they were unable to show change because they don't really have a problem. In the Kansas watershed, they simply did not have sufficient water quality monitoring, they didn't get their conservation practices into critical areas. Utah couldn't show change because its water quality data were so bad. Nebraska was able to show change. Indiana couldn't show change because what they were really interested in was nutrients and yet none of their practices fixed nutrient problems, they were all focused on sediment and erosion.

Q: Back on the SPARROW model, you concluded that you didn't have a lot of confidence in it. Just to summarize, that was because you didn't have confidence in the people running the models or you weren't confident that they were provided with adequate data to put into the models or both?

A: First of all it's a regression model so it's not physically-based. I have problems with regression because it kind of indicates cause and effect and you have to be careful with cause and effect. Most of the people who work for USGS are water scientists who have limited knowledge of agriculture so sometimes they don't understand the agricultural system they are dealing with and that was my experience working with the SPARROW model here in North Carolina.

Mr. Steve Walker then went over the agenda.

E. ANNOUNCEMENTS & UPDATES

Mr. Walker then read the announcements to the group. He said that all four of the Missouri MRBI projects were awarded funding and will receive $7.9 million over the next four years for these projects. He then said that the Soil and Water Conservation Program (SWCP) had applied for and received an $118,000 EPA section 104 (b)3 grant to assist in developing the Missouri Nutrient Reduction Strategy. He stated that there was $ 80,000 in contractual money to hire some graduate students to help in drafting sections of the strategy, doing some GIS overlay maps, color figures and to help us out with some spreadsheets and modeling. Mr. Walker stated that there is also have about $10,000 for printing and binding cost at the very end to put the final strategy document together. Mr. Walker then stated that the program also applied for and received $20,000 in EPA contractor assistance for help in putting together a nutrient loading potential spreadsheet what will be in an excel spreadsheet. He said the contractor will help put together all the different federal and state GIS data layers that are available that may be useful in prioritizing our watersheds and we will probably use our temporary employees that we hired to assist the federal contractor.

Mr. Walker then thanked the EPA, especially EPA region 7 and Bob Angelo and Karen Flournoy for supporting the application for those funds.

Mr. Walker then let the committee know that the SWCP applied for a Conservation Innovation Grant (CIG) grant for nutrient trading and that the results have not been received yet. He stated that the program should hear the results by July 20th. He said the CIG grant is a three-state effort between Missouri, Kansas and Oklahoma to develop a nutrient trading framework that would use the Nutrient Tracking Tool model and include some of the policies that we may use in the future for nutrient trading in Missouri.

F. INTRODUCTIONS

The attendees were then introduced

G. PRESENTATION- BMP Database Projects-Erick Strecker, Geosyntec, Inc.

Mr. Strecker then gave a presentation on the International BMP Database and an effort that's underway now to establish an agricultural BMP database which can be seen below:

Why do we have a need for improved BMP design and performance information.

- Increasing national scale agricultural water quality regulatory requirements/attention
    - Gulf Hypoxia
    - Chesapeake Bay
    - Central Valley, CA
- Local TMDL(total maximum daily loads) efforts, in part, targeting Agriculture
    - Hinkson Creek
    - Big Muddy Creek
    - James River
    - Elk River
    - Several Others

Agricultural BMP Performance Information

- Significant work on Agricultural BMP design and performance have been completed around the country:
    - Conservation Effects Assessment Project (CEAP)
    - Land Grant Colleges Efforts (e.g., North Carolina State)
- However, it has not been typically completed and/or reported in a consistent manner such that it can best be utilized for informing BMP effectiveness for planning and implementation programs.

What is the Agricultural BMP Database Effort?

- A nationwide agricultural BMP monitoring/reporting protocols and performance database
- Modeled after the existing International Storm water BMP Database (www.bmpdatabase.org)
- Designed to be an important resource for addressing some of the nation's most challenging water quality problems.

Agricultural BMP Database Benefits:

- Improve BMP Selection and Design
- Inform regulatory agencies on BMP Performance
- Improve predictive tools for estimating pollutant loads and load reductions from agricultural lands with implementation of BMPs
- Help identify potential causes of regional differences in effectiveness
- Providing a central repository for field data collected as part of the CEAP or other efforts.

International BMP Database Overview

- BMP Database now includes over 510 BMP monitoring studies, including significant green infrastructure/LID(low impact development) BMPs
- From 2008-2012, a key focus has been to better integrate green infrastructure through:
    - Monitoring guidance (updated)
    - New and Updated reporting protocols
    - Updated analysis protocols
    - Updated user friendly data acquisition

The Urban BMP Information Problem (1994 and Now)

- Widespread use of Urban BMPs without sufficient understanding of performance and factors leading to performance
- Inconsistent data reporting methods limited scientific comparison/evaluation of studies
- Differences in monitoring strategies and data evaluation methods result in wide range of reported "effectiveness" (e.g., – to + percent removals)
- Difficult to predict potential performances to inform decision makers.

Project History

- 1994-96: UWRRC of ASCE identified the need to address urban storm water BMP performance in a systematic and scientifically rigorous manner
- 1997-fall 2003: ASCE/EPA Cooperative Agreement
    - Develop standardized BMP performance data reporting protocols
    - Compile data of BMP performance in USA and other countries (bibliography compilation & review)

    - Develop a database and store data on BMP performance, the facility's site conditions, and design parameters (1999 CD)
    - Analyze data using rigorous standardized statistical protocols
    - Developed monitoring guidance
    - Developed website (www.bmpdatabase.org)
- 2004 to present: WERF Led coalition

Recent Major Changes

- Integrated/Re-categorized LID practices
- Restructured database to improve user friendliness
    - Storm event structure, water quality nomenclature, monitoring station-BMP pairing
    - User's guide & on-line search engine update
- Restructured manufactured device category to better differentiate among manufactured device unit processes

BMP Monitoring Guidance Revised Fall 2009

Highlights

- Developing a monitoring plan
- Integration of LID Site-level Monitoring
- Explanation of statistical performance analysis protocols
- Detailed flow monitoring guidance

www.bmpdatabase.org

General BMP Information Maintenance and Condition of BMP

- Maintenance Type/Frequency
- Last Rehabilitation Date
- Type of Rehabilitation
- Qualitative evaluation of condition
- For BMPs w/out permanent pool, does surface ponding exist beyond design drain time?
- If clogging present, est. %of total surface area affected

BMP Summary

- New Green Infrastructure BMP Categories
    - Bioretention
    - Green Roofs
    - Rainwater Harvesting
    - Site-Scale LID
- Adding more studies is an ongoing important objective
- Most recent version posted in January 2012

BMP Category-level Performance Analysis Summaries

- Provides a series of interpretive technical summaries (see www.bmpdatabase.org)
- Technical summaries prepared for
    - Solids
    - Bacteria
    - Metals
    - Nutrients
    - Volume reduction
- WERF Research Digest provides overview of all of the summaries
- Summaries provide regulatory context, unit treatment process information, data summaries, conclusions, recommendations, statistical summary
- Statistical analysis updated Feb. 2012

Statistical Appendix

- Summary Statistics for Each BMP Category Constituent combination
- Basic Descriptive Statistics (storm-weighted)
    - # samples
    - # non-detects
    - Mean, median, quartiles, etc.
- Comparison of confidence intervals for medians on boxplots
- Hypothesis testing
    - Mann-Whitney Rank Sum Test (unpaired)
    - Wilcoxon signed rank test (paired)

Solids (TSS, TDS, Turbidity)

- As of 2010, EPA had identified over 6,270 water bodies across the country listed as sediment-impaired
- Excessive sediment can adversely impact aquatic life and fisheries, source waters for drinking water supplies, and recreational uses.
- Also of interest because particulates often "carry" other pollutants (e.g. metals, nutrients) so removal of TSS can also reduce sediment-bound pollutants.
- Constituents analyzed in 2012 Technical Report Series:
    - TSS- Total Suspended Solids (5,500 records)
    - TDS – Total Dissolved Solids (1,500 records)
    - Turbidity (750 records)
    - Most data sets do not provide suspended sediment concentration (SSC) & particle size distribution, although these parameters are of interest.
- TSS was updated in 2012 addendum (>10,000 records).
- Key results:
    - Most BMPs performed well for TSS reduction
    - Median effluent concentrations <25mg/L
    - Median effluent concentrations for bioretention, media filters, wetland basins approximately 10mg/L

    - TDS more challenging
    - Turbidity similar findings to TSS

Fecal Indicator Bacteria

- "Pathogens" are the top cause of stream impairments (>10,000 listings). Most BMP studies report fecal indicator bacteria, not pathogens.
- Most BMP studies have historically reported fecal coliform; recent studies report E. coli and enterococcus (the currently applicable EPA-recommended criteria).

Nutrients

- As of 2010, over 14,000 water bodies in U.S. impaired for nutrients, organic enrichment, algal growth, and/or ammonia.
- The nutrient analysis for the BMP Database focused on
    - Phosphorus
    - Nitrogen
- >50,000 nutrient records in BMP Database

Selected Conclusions for Nutrients

- Phosphorus:
    - BMPs with permanent pools appear to be effective at reducing concentrations of major forms of phosphorus.
    - Detention basins reduced total P
    - Vegetated BMPs)bioretention, swales and filter strips) did not perform as well
    - Bioretention media characteristics important (P index)
- Nitrogen:
    - BMPs with permanent pools appear capable of reducing nitrate concentrations, but may increase organic nitrogen, (opposite of swales/media filters)
    - Media filters show relatively high TKN removal and low nitrate removal.

Volume Reduction

- Volume is increasingly regulated as a primary or surrogate constituent of concern
- Volume reduction goals (or "Retain on site") are explicit in various recent regulations (e.g., EISA Section 438, TMDLs, some MS4 permits and state standards).

Volume Reduction and the BMP Database

- Volumetric data have historically been collected to support WQ measurement (e.g., flow-weighting) and more recently as primary objective of studies
- Screening is essential to excludes studies that are not appropriate for volume reduction there are important considerations related to potential for bias in screening
- After screening, volume analysis data set included approx. 1,900 paired events and 60 studies
- Data sets entered in late 2010 not included in analysis due to timing.

Selected Conclusions for Volume Reduction

- Normally-dry vegetated BMPs (filter strips, vegetated swales, bioretention, and grass lined detention basins appear to have substantial potential for volume reduction on a long-term basis, on the order of
    - 30% for filter strips and grass-lined detention basins
    - 40% for grass swales &
    - Greater than 50% for bioretention with under drains
- Also can reduce frequency of discharge
- Retention ponds & wetland basins & channels do not appear to provide substantial volume reduction on average
- Variability in volumetric performance between studies indicates that design attributes & site conditions likely play key roles in performance

International BMP Database- Recommended Performance Description

- How much of the runoff that occurs is managed by BMP or not ("hydraulic performance")?
- How much storm water runoff is prevented ("hydrological source control")
- Of the runoff treated and released, what is the effluent quality? ("concentration characteristics achieved") How does it compare with pollutants of concern levels?
- Does BMP address downstream erosion impacts?

Approach to Developing an Agricultural BMP Database

- Build on framework for receiving, managing and reporting BMP data is well established for the International Storm water BMP Databases
- Identify agricultural-specific data types and formats,
- Develop/adapt monitoring and data collection protocols and
- Adjust the data entry and retrieval processes to meet the needs and objectives of the agricultural community and water quality agencies.
- Leverage off of existing USDA programs and procedures to the extent possible
    - Conservation Effects Assessment Project (CEAP) is a multi-agency effort to quantify the environmental effects of conservation practices (i.e. agricultural BMPs) at the national and watershed scales.
- Identify potential sources of data for initial populationg of the database
- Build and load database
- Conduct initial assessment of BMP Performance

Phase I Agricultural BMP Database Effort

- Identify agricultural BMP types and design parameters needed to evaluate performance.
    - Build on existing efforts (e.g. NIFA-CEAP, bibliographical databases)
    - Reporting parameters from existing models (e.g. APEX, SWAT, KINEROS)

- Develop simple Excel spreadsheet data entry tool that summarizes the BMP types and reporting parameters that will enable standardized entry of agriculturall BMP studies
- Stored entered data in Access Database (similar to urban BMP Database)

General Approach to Developing Reporting Framework

- Keep it simple for initial product – Excel spreadsheets providing standardized input fields for information related to :
    - Test site
    - Tributary wwatershed
    - Practice type (s)
        - Individual practices – "bins" of similar practices
        - Site-scale practices (multiple)
    - Practice Design/Operational Aspects
    - Monitoring Design Characterization
    - Monitoring Data: Precipitation, Flow Water Quality

Don't Reinvent the Wheel

- Initial steps have included inventorying previous database efforts
    - Virginia Tech (Gene Yagow)
    - MP Miner, CA
    - NRCS CEAP (Google Earth/Database)
    - Others
- Will follow NRCS practice codes/names
- Reviewing key agricultural models for practice design input parameters

Literature Review (IN Progress)

- Limiting initial effort targeted on row crops
- Progress to date: master spreadsheet of papers/studies from universities, cooperative extension, and NRCS/ARS.
- Some of the existing "databases" are essentially literature reviews

Uses of BMP Performance Database- Nutrient trading

- Trading Margin and Ratios
    - What footprint of BMP needed to achieve trade targets?
    - Improve reliability of model predictions
        - Transferability
        - Scalability

Uses of BMP Performance Database- Simulating Nutrient Reductions

- Nutrient Reduction Planning
    - BMP site suitability
    - Seasonal and regional effects

    - Informs engineering design and practice implementation
    - *What is achievable & why?*
- Watershed planning
    - *What is the most cost effective mixture of BMPs to achieve nutrient reductions?*

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Max Starbuck National Corn Growers

Mr. Strecker then answered questions.

> Q: It seems to me that in urban practice database you had a lot of individual practices. I know in the agricultural world often to reach a certain water quality goal it's necessary to have more than one practice that is used concurrently. Are there any attempts to characterize a combination of practices in that database?
>
> A: I mentioned low impact development and distributed controls so in the urban world if you had a catchment that had swales on it with every street and you didn't want to monitor every one of those individually you may want to go down to the bottom, and we have protocols for this now, and maybe they had disconnected roof drains and rain gardens and green roofs, we have protocols now to characterize what level of treatment they have and what does the watershed look like and then do comparisons and certainly the best situation would potentially be side by side catchments or ones where you go in and retrofit and do before and after, but also have the ability to take in the study site and the corresponding information on the level of distributed controls is applied. For this database, we're depending on studies coming in, but for the benefit of all, what would make the most sense is having individual studies and distributed multiple-control studies.
>
> Q: Do you have any target dates for completing the agricultural BMP databases, does that depend on receiving more resources to get the job done?

A: We have the resources now for the Phase I part of the work but the rest of it will be based on additional funding.

Q: You have any idea what those amounts are?

A: I would estimate $250- 275,000 or something like that and for the initial efforts $50,000. The actual grant was probably 1 million dollars.

Q: Are you going to be looking at anything dealing with farming systems and how that actually affects the utilization of that BMP whether it's no-till or minimal till or anything like that?

A: We'll be asking folks to provide that information as part of the watershed attributes they'll be asked about the farming activities all of that.

Q: Are you going to focus on only structural practices or include management practices?

A: We're going to include management practices as well. On the Urban world if you look at a BMP that's going to make a 10 or 20% difference, it's very hard to pick that up in storm water monitoring.

H. PRESENTATION- Continuous CRP Program – Allen Powell

Mr. Allen Powell stated that the conservation reserve program (CRP) protects millions of acres across the United States by protecting top soil from erosion and it is designed to ensure the safety of the nation's resources, not only water runoff and sedimentation, but it also protects groundwater and the condition of streams, lakes and ponds. By planting vegetative cover, sometimes trees, that make a major contribution, this also increases wildlife populations. Mr. Powell stated that there are a couple versions of the conservation reserve program (CRP):

1. The general signup where most of the acres come from. These have eligible producers that submit offers to enroll in CRP during the signup up period (e.g. we had one back in March and April that lasted 5 weeks) and the producers come in and submit an offer. Their offer is looked at through a system called the environmental benefits index scoring system which gives the producers points based on how their offer enhances wildlife, how much erosion is occurring and according to what type of cover (e.g. trees will have more points than grass). All these offers are on a nationwide basis and are compared at the national office.
2. CRP continuous signup where producers can enroll throughout the year on environmentally sensitive areas for conservation practices that are geared towards either filter strips, as far as runoff is concerned, to riparian buffers on the bottoms, to quail strips on the upland and producers can enroll throughout the year and there's not a scoring process for continuous CRP. If the producer has met all of the eligibility

requirements and the practice he wants to put in is eligible, he's automatically enrolled in the program. In the state of Missouri for all of CRP acres, there are about 1.4 million acres in the total CRP program. Of that total, about 137,000 acres are enrolled in continuous CRP. Continuous CRP has a large # of practices that are listed below:

(a) CP21 – Filter strip acreage that's physically in the bottom along your streams or sink holes or could be on any other wet area. These filter strips can be enrolled for about 10-15 years and the minimum width is 25 ft. up to a maximum of 125 ft. These would be typically planted to a mostly more warm season type grass mixture with a few legumes involved with that. Some are older with a cool season mixture. What most producers do is they are going to enroll this on one side or the other (sometimes both) of the stream if they have a stream running through the full length of their property to catch some of the sediment running into the stream or slow down some of the water when we have overland flooding.

(b) CP22- Riparian buffers – 10-15 year contracts, planting trees or shrubs, width: 50 ft minimum - 180 ft maximum. Not as popular as the grass filter strips.

Mr. Powell stated that both the above practices have good incentives such as a signup incentive payment which gives producers an extra $100 for signing up to go into the program and a performance payment for their practice incentive on top of their cost share (50% is what we normally pay). He said that this pays somewhere between 85-95% of getting the practice established .Most have a soil rental rate incentive which is for CRP producers. When they enroll, everybody gets their dollar basis for what we're going to pay based on their soil rental values, He said that for most of our low land areas through the state, most producers may get $120-140 per acre for a normal soil rental rate, but with this incentive they can also get an additional 20% on top of that.

He said other practices include:

(c) Shallow water areas which have two or three names based upon typically whether they're smaller or larger areas or whether they are within the 100 year flood plain or outside the 100 year flood plain. It was just announced for shallow water instead of $100 incentive we are going up to $150.

(d) Marginal pasture land wildlife buffers are buffers that we can put in the bottom and that's where in some cases producers have some scattered areas of trees and maybe they've been pasturing it and its not cropable; therefore, we can go in there and create a buffer and get some cows out the stream .

(e) CP33 is the habitat buffers for upland birds, called quail buffers, they have a lot of associated benefits not only in putting a buffer strip around the field of 30-120 ft. maximum around that field where its going to be heavily concentrated on seedings but also you're getting some erosion protection all around the field. Mr. Powell stated that waterways are not really utilized that much through FSA, but that's a good practice and FSA does offer the $100 incentive and there is a soil rental incentive on that. Couple other less popular programs FSA has are:

(f) Contour buffer strips- which are intermediate contour grass strips on upland hills with grass and then row crops and then more grass.
(g) Crop windtrap which is available only down in the Bootheel area.
(h) Wetland timber or wetland buffer type programs for down in the bottoms as you're getting into your bottomland hardwood species.

Mr. Powell talked about the more popular programs which includes the CP21 filter strips. He said currently FSA has about 39,000 acres of CP21 in the state, and CP33 has about 35,000 acres. He said that in the shallow water areas, FSA has about 15,000 acres of those in the state. Mr. Powell said there is a SAFE program which is geared towards wildlife and FSA works with MDC to come up with project proposals for the state. Mr. Allen Powell said that when it comes to the overall CRP program this last year in Missouri, FSA had about 377,000 acres that are expiring. He said FSA has about 231,000 acres that were newly enrolled or re-enrolled; therefore, FSA is about 140,000 acres short of what was expiring and of that 231,000, about 65 or 75% of that was re-enrollment. This means that only about 30-35% was new acreage coming in so there's about 50-60,000 acres of CRP that's coming out that was not re-enrolled and the majority of it will probably go back into production. Mr. Powell stated that Missouri in 2013 will have 185,000 acres that are expiring making 2013 one of the biggest years as far as acreage expiring for FSA. He said nationwide there's currently about 29.5 million acres in CRP and 6.5 million acres was set to expire this fall. Of that 6.5 million, 4.5 million was either offered or newly enrolled.

Mr. Allen Powell then answered questions.

Q: If a producer takes say 200 acres out of CRP and decides to farm that what do they have to be able to do to farm it?

A: Typically since they have been out of the loop, what they would have to do is come back in and get a farm plan and farm according to that plan if they want to stay in compliance with all the government programs.

Q: What's the reason that they expire the acres?

A: Those acres that came down over the years as with the farm bill they cut down on what the maximum amount of acres we could have in CRP nationwide.

Q: When you said some large tracks of land come out and you can resign up with continuous filter strip is there any impact to the land owner, do they get the current crop rental rates or do they need to do anything special since they're going out and leaving part of it in the filter strip?

A: Typically in most cases in the last few years, our seating has changed somewhat for what's available on these continuous programs. You'd have to re-establish a different cover therefore looking at the new updates on soil rental rate plus incentives.

Q: Does FSA still offer the CREP program?

A: CREP was a program initiated a few years ago and in order for it to be offered the state has to be willing to put some money towards that. We had contacted the state of Missouri on a few occasions since then about the availability to CREP and we were kind of told that money just wasn't available to sponsor that program.

Q: Is there future opportunities for that type of partnering for utilizing the CREP program.

A: Currently, the way the farm bill is set up we don't know what's going to happen with the new farm bill, but at this time I would certainly think they would keep that open and available. Like I said, it has to be a partnership between our agency and the state and it's all going to come down to what's financially available out there.

Q: On the acres not enrolled in CRP are you seeing any trends in your data to show that the more highly erosive acres are not being enrolled or the ones that barely met the CRP requirements are not being enrolled or is it a landowner preference?

A: We really don't have anything that tracks that once it comes out of CRP they're basically off of our books and we don't track anything they do. From the guys we've talked to around the county, if they take it out of CRP they're planning on row cropping it.

I. MODELING, SUGGESTIONS & COMMENTS – Steve Walker

Mr. Walker then moved onto the next item on the agenda which was modeling. He gave a brief overview of the SPARROW model. Mr. Walker showed a few slides to depict some reasons why the committee should use models or consider using models.

<u>Why use models?</u>

- Water quality monitoring provides measurement accuracy and is important in calibrating and validating models, but monitoring is one of the most expensive project evaluation methods.

- Agencies and stakeholders lack sufficient resources to install and maintain all of the necessary monitoring stations, on all fields and all watershed outlets, to fully evaluate all project benefits.

- Other drawbacks to monitoring include the time delay involved in collecting and analyzing environmental data and difficulties in evaluating some conservation practices with monitoring (i.e. filter strips, riparian forest buffers).

- However, it may be possible to provide comparable estimates of field-level and watershed-scale effects of best management practices using models, which are faster, more efficient, and more affordable than monitoring.

Mr. Walker stated that all models need to be tweaked occasionally. He said that he would personally like to use models as one of many tools during this process and with the SPARROW model it has been endorsed and adopted by all of the states that are members of the hypoxia task force. He continued on with his power point as depicted below:

SPARROW MODEL

- SPARROW is a USGS process-based, mass- balanced, statistical model that can be used to estimate the major sources and environmental factors that affect the long-term supply, transport, and fate of contaminants in streams.
- SPARROW stands for Spatially References Regressions on Watershed Attributes.

SPARROW MODEL ATTRIBUTES

- SPARROW is calibrated by statistically relating watershed sources and transport-related properties to monitoring based water quality load estimates.
- 2,736 stream monitoring site sampled by 73 agencies were identified as having suitable data for calculating long-term annual nutrient loads required for SPARROW model calibration.
- All areas of the county have sufficient water quality data to compute accurate annual loads and support regional modeling analyses.
- Regional SPARROW models simulate long-term annual stream nutrient loads as a function of known sources and climatic (precipitation, temperature), landscapes (soils, geology), and aquatic factors affecting fate and transport.

SPARROW MODEL OUTPUTS

- SPARROW outputs have confirmed the dominant effects of urban and agricultural sources on stream nutrient loads, but revealed considerable spatial variability in the specific types of sources that impact water quality.
- Have been used in TMDL assessments of nutrient loadings.

SPARROW MODEL PROCESSES

- SPARROW model outputs are based on "older" data (2002) so all datasets used are compatible
- Data from the EPA PCSS national database are used to calculate annual N and P loads from municipal and industrial facilities.
- States vary in their requirements for nutrient monitoring by NPDES dischargers
- SPARROW estimates urban storm water runoff using a standard area loss component (kg of nutrients per sq. km). It does not account for combined sewer overflow (CSO) discharges.
- Fertilizer use data in urban areas is not currently available. If available, this information would significantly improve estimates for urban storm water runoff.
- If no data are available for specific nutrient sources, SPARROW uses average default values. If default values aren't available, estimates for those sources are not calculated (e.g. some industrial minor dischargers and municipal sludge applications may not be listed in PCS).
- Since SPARROW is a mass-balance model, if data for specific sources are not available, those loads will be attributed to other nutrient sources.

Comment: having a model that looks at the entire Mississippi watershed is a useful tool and we need something that begins to look at where nutrient loads are coming from so having a model like this is very useful and important.

Comment: One of the limitations of the SPARROW model is that it is primarily statistical and a multiple regression type model rather than a physically processed based model that considers the various nutrient kinetics, etc. Therefore, when we want to start evaluating various BMPs or practices, there's really not a way in the SPARROW model to evaluate that because the predictions are based on the data that the model was constructed with and if those BMPs weren't installed when the model was being constructed and the data collected it's really pretty challenging to test that effect in the model, so my concern with SPARROW is it kind of limits our ability to run various scenario analysis and what can be achieved with various BMPs.

Q: Does anyone know if the amount of practices in the drainage area is one of the input of SPARROW?

A: In terms of the various regression variables that went into predicting the phosphorus loads, an array or menu of various BMPs wasn't included in that.

A: About 2 years ago, there was a presentation that they were at least beginning to expand the number of sources included in the SPARROW model and the more sources you get, the more this mass balance element becomes less prejudicial, but from what I understand, even fertilizer rates were based on county sales so they didn't know where that fertilizer was going or the type of crop application it was going on, so I can't believe how they could turn around and have any type of BMP effectiveness analysis when you're dealing with just coarse elements of county assumptions on fertilizer application rates.

Q:Within Missouri, how many monitoring stations does there exist that SPARROWS been developed for?

A: I'm thinking maybe a dozen sites, but I could be wrong.

A: I was looking at output files and there are SPARROW predictions for hundreds of small watersheds as well as the larger ones.

Q: What spatial scales are we extrapolating the results from; a few streams or few systems to larger systems?

A: I can't answer that completely. I know that we focused on 10 sites that had the most nitrogen and phosphorus data in the states that would have been the larger rivers that USGS samples for us. The predictions that we made on loads using concentrations and flows were very close to USGS so I'm sure they are taking advantage of those sites, but how many smaller sites with less data that they may be using, I do not know.

Comment: five years ago, the SPARROW model needed historical flow data for a long period of time because it was embedding it into a national context for averages, so that's why it's using agricultural data from 2002 because it's actually more linked to having data sets to do with precipitation and flow events that were statistically justifiable. Certainly 6 years ago, the load was based off a very small number of monitoring stations that had historical time frames that would allow them to achieve what they needed statistically for the model.

A: I think on the Mississippi River, there's three or four stations on the border of Missouri that I think are included in those calculations and as far as the 8 digits HUCs I think there's probably 30 or 40 different stations that have been in place for over 10 years at the bottom of a lot of those 8 digit HUC watersheds so I would assume that data has been used in SPARROW.

Comment: I think there are some other opportunities out there to pursue a broader consideration of processed based modeling. I think with cloud computing approaches and technologies out there that it's possible to set up these more robust models whether it be SWAT or HSPF, and you can run these on the cloud with various management scenarios whether it be BMP, structural BMPs, or practice type BMPs and kind of get a feel for what we can achieve in different places and where to prioritize our efforts. If we go down this modeling path, there are some other opportunities out there to think about.

Comment: I think any of these presentations are informative and would be useful to us for a variety of reasons. I am hopeful that we're going to come up with a menu or a tool kit that landowners are going to be able to go to and see as recommendations for ways of trying to manage nutrients relative to water quality. I don't know that modeling is something we should spend a whole lot of our effort on it as a group but maybe it's better to focus on some of the things we can come up with in the way of recommendations for both urban and rural areas to control nutrients.

Comment: that's actually valid and what we want to do is come up with those actual nutrient reduction strategies for all of the different nutrient sources in the state but we also have a need to prioritize our watersheds and identify what the critical areas are within those watersheds so we can hopefully one day target more of our resources in those areas. We also need to know which nutrient sources are contributing most of the loadings that we see in a given watershed and the SPARROW model, has the ability to do that and that's very valuable from a planning perspective.

Comment: MRBI is a good example for this group to consider the use of the SPARROW model and this very coarse model can transition into SWAT or other models that have validated themselves as being perhaps being better tools at a smaller watershed level. MRBI when it first came out used all the SPARROW models HUC 8 watersheds that were identified in Missouri as being the eligibility zones by NRCS. It's a very good coarse tool, gives you general indications of where you want to spend some more time, but it may not be the tool to drop down into detailed HUCs, at least not as it exists today.

Q: So if the SPARROW model or some other model like that is something that we use, how can we then translate that into our watershed groups and practices.

A: Although a waterbody' overall load to Gulf hypoxia is fairly insignificant in the realm of other much larger loads, does that mean that that waterbody is not important to the state of Missouri for our own water quality needs? Of course it is important to the state of Missouri, so the SPARROW model as it has been used recently has been driven by total load to the Gulf of Mexico, now it can be driven by other loads.

Q: What is done with the stream teams' data has it been QAQC'd at all?

A: Right now all the data that comes in from the stream teams, is going into the new database that's been developed by the Department of Conservation and it's shared by them and DNR. The data as it comes in is quality assurance checked by DNR and once that is completed, the data then goes into the stream database and there's a little checkbox that says yes this data has been QAQCd to make sure that the location is correct and obvious flags like pH values out of range have also been checked.

Q: I was just wondering if some of these models you guys talked about or the SPARROW model, if that database can be uploaded into it and run it once and see if it helps whatever that maybe.

A: I think the issue of most of the stream team data is that the nutrient kits that they use are not EPA approved methods they're very approximate and they would probably make the SPARROW predictions even coarser than they are now.

Q: The lakes in Missouri have volunteer data, where they freeze the samples and send it to a certified lab to be tested, would that kind of data be available to use in something like that?

A: The quality assurance level on the volunteer lakes data of Missouri is very high we make use of that data for all uses.

Q: So if that was expanded to stream data, would that same type of testing and level accuracy be used?

A: Yes everything depends on the method, if an EPA approved acceptable method is used, then we'd use it for any method or application.

Mr. Walker then continued on with his presentation (depicted below) after comments, questions and discussion.

SPARROW MODEL PROCESSES

- SPARROW is continually being improved based on input received from users
- In October 2012, new updates to the SPARROW Mapper model will be available.
- State personnel are available to provide assistance.
- SPARROW Mapper is a new interactive web-based model that can be used to dial down to the 8-12 digit HUC watershed scale
    - Estimate N and P loadings at the outlet of watersheds
    - Estimate percent contributions of nutrient sources
    - Test modeled scenarios of future conditions (i.e. climate change, reductions in specific nutrient sources)

SPARROW MODEL ENDORSEMENTS

- In 2009, the National Research Council panel cited SPARROW as an important information tool that can assist in identifying priority drainage basins for targeting management and nutrient control efforts in the Mississippi River Basin.
- Used in USDA, USEPA, USACE, NOAA, and many states including AR, CT, FL, KS, LA, MD, MN, MS, and NY.

Mr. Walker then answered questions.

> Comment: Something else we talked about in previous meetings is what other data sets are out there because we've got the unified watershed assessment that the NRCS has done, we've got the MOEAC which looked at 12 digit HUCs we've got several different ones that are out there that looked at a series of different data and said that these are critical watersheds for these reasons. If we could combine them, and use these other assessment tools that have already been used to identify particular watersheds and then identify those that come together and then run something like SPARROW there it may actually help so it cuts down the amount of time needed to do the model work a lot.
>
> Comment: On fairly large watersheds that we could make pretty accurate load estimates for nitrogen and phosphorus if you looked at those and compared those to the average levels of nutrients in the stream, the correlation was astoundingly high so really in practice if we're talking about nutrient loading in a watershed we're also talking about nutrient concentrations in the stream.
>
> Comment: In looking at the bigger picture, anytime we do TMDL or water quality type exercises, if we see a problem, the first question is where did those contaminants come from that contributed to this problem? One of the things I always look for when dealing with a nutrient situation is just the question, what value do we need to reach at what spot? If we have a problem in a lake we can figure that out, if we have a problem in a flowing water body going into that lake,

then we ask the question, which is really the critical criteria that drives the solution? If you really need to reduce the stream more than the lake then contributions to the stream are the ones you're going to pay attention to, not so much those that end up showing whatever criteria you reach in the lake.

Comment: The best thing we need to be able to do first is say what the sources are and where are those sources coming from and then what BMPs are the most effective for reducing that load that way. Now once we've got that out of the way, we can look at the model and say what the critical watersheds are.

Q: The Our Missouri Waters Initiative HUC 8 watersheds that they're looking at around the state (3 or 4) as a pilot project, how does this factor into this strategy?

A: I wouldn't say that they're directly tied to each other, any effort that we undertake to try and address watershed protection type of work will fall to some extent under the initiative. We've started with looking at 3 specific HUC 8 watersheds and this is more of a statewide strategy; therefore, although we're doing other things under the initiative it goes back to what are we trying to address, what is the strategy trying to address, is it trying to address localized watershed level nutrient issues or is it addressing the larger scope into the Mississippi type of level, and if it's the latter, then there's going to be less influence from the Our Missouri Waters Initiative.

Q: From the Gulf hypoxia standpoint, is phosphorus or nitrogen the main stressor nutrient of concern or is it an equal combination of both? I'm wondering if from a statewide perspective we are more concerned about nitrogen or phosphorus and then within the state, which of those two nutrients seems to be more of a problem because that in turn affects the BMPs that we would be focusing on.

A: If you talk to our lake limnologist, they would tell you most lakes are phosphorus limited most of the time; however, saying that, almost any body of water can at times be nitrogen limited and other researchers have documented that a lot of streams in Missouri particularly in the summer during low flow periods are nitrogen limited and that has nothing to do with the problems in the Gulf as that's a totally different limnological system, but generally its more likely to be phosphorus most of the time for lakes, and for streams, its up in the air. A lot of our streams are turbid enough that neither nitrogen or phosphorus is limiting.

Comment: Another thing that I always think about when we look at a project is who's going to carry out the nutrient reduction strategy. Who's going to be responsible for pushing that forward, what group of agencies or what partnerships

are going to be formed to carry out that strategy? I think that should really play into how the strategy is written.

Comment: EPA has a certain criteria as to what this strategy will incorporate or the components that are going to be in the strategy so if those are hard facts, we have to hit every one of those. We need to know what those mandatory components are that we've got to hit.

Comment: There's 8 elements that EPA requires so those components need to be in our strategy and watershed prioritization is one of those, but if we default to those listed on the 303(d) list as our priorities that would be our process for that.

Comment: You kind of have to look at what tools you have available and in the state of Missouri, we have remarkable tools such as the Soil and Water Conservation Program, a complex set of practices, a very dynamic program that can change some of those practices by bringing them in front of the commission to develop new approaches, an evolving NRCS program, that through the MRBI and other watershed approaches is become far more dynamic. So I think that you can make a lot of progress by looking at what the sources of nutrients in the state of Missouri and then what tools are available in the state of Missouri and begin to address those issues and then identify a desire to embrace prioritization of those efforts whether it be through the Our Missouri Waters Initiative, or developing lake criteria, and then eventually through stream criteria.

Comment: From the TMDL world, you have to look at all your sources and then look at what each of those sources contribute, and once you've done that you, look at what mechanisms you have or what mechanisms you would like to put in place to handle that nutrient loading. Then, that's where you get into the details of what are all the treatments possibilities for those pollutants? What are the economic incentives that are there, or could be there for those sources? What are the regulations for those sources, either in hindrance to reductions or promoting those reductions? Are there regulatory barriers that need to be overcome for each of those sources? And, once you break it down like that, you get away from watershed prioritization.

J. ADJOURNMENT

Mr. Walker thanked everyone for participating and the meeting was adjourned.